Meeting Log

Subject: Second Meeting of Technical Advisory Committee (TAC) for The National Carbon Monoxide Detection Research Project - Phase I, Literature Review and Technical Analysis Plan

Meeting Date: June 12, 1996

Place of Meeting: National Fire Protection Association (NFPA) Headquarters, Quincy, MA

Date of Entry: June 14, 1996

Source of entry: Tim Johnson, ESEE

Commission Attendees:

Tim Johnson, ESEE

Non-Commission Attendees:

Doug Brown - NFPA Research Foundation
Rick Mulhaupt - NFPA Research Foundation
Paul Patty - Underwriters Laboratories (UL)
Ivan Nelson - Quantum Group, Inc
Ronald Mengel - System Sensor (represented NEMA at meeting)
Val DiGiovanni - American Sensors
Wendy Gifford - BRK/First Alert
Ed Godziszewski - Figaro USA Inc.
Andy Persily - NIST
Glenn Smith - National Association of State Fire Marshalls
Frank Stanonik - Gas Appliance Manufacturers Association (GAMA)

Summary of Meeting:

Second meeting of Technical Advisory Committee (TAC) for The National Carbon Monoxide Detection Research Project - Phase I. Phase I work involves a literature review, technical analysis of this literature, and a proposed plan for further study. Implementation of the study plan would be pursued if literature to date is insufficient to provide recommendations on CO detector placement. A separate TAC would be formed for subsequent phases of this project. The eventual goal of the project is to develop data on CO dynamics in family living units such that recommendations can be given regarding detector placement in the living unit. This meeting was organized and facilitated by the National Fire Protection Research Foundation as will future meetings of the TAC.

Discussion:

A call to order was issued by Rick Mulhaupt, NFPA Research Foundation, at 8:30 am. This was followed by self introductions and a brief overview of meeting objectives, project objectives, and phase I objectives by Mr Mulhaupt. The timeline established at the first TAC was reviewed and progress to date noted.

TIMELINE for completion of phase I of CO detector research project.

Task	Approx date	
1st TAC meeting	2/29/96	(DONE)
Start contract NIST (Andy Persily)	3/15/96	(DONE)
TAC input to Mr. Persily, re: contacts/data sources	3/22/96	(DONE)
DRAFT report of literature review to TAC	3/31/96	(DONE)
2nd TAC meeting	6/12 or 6/13	(DONE)
Mr Persily/NIST to conduct tech. analysis/study proposal	6/14 - 8/2	
3rd TAC meeting	8/14 or 8/15	
Issue RFP/RFP response	8/23 - 9/20	
4th TAC meeting	9/26	

The main topic of the meeting was a presentation by Mr. Andrew Persily, NIST, discussing results of the literature review he conducted on behalf of the TAC, as well as some initial thoughts on an approach for a technical analysis of the material uncovered during the literature review. In addition, Mr Persily will have a draft study plan developed for the next TAC meeting. Both the technical analysis and the study plan will be reviewed in detail at the next TAC meeting, tentatively scheduled for two days, Aug 14-15. At that meeting the TAC will make decisions on:

a) Whether to pursue the study plan proposed by Mr Persily (or any further study in the area of CO detector placement in the home, i.e. phase II),
b) Whether to retain Mr Persily/NIST for phase II work, i.e. implement the study plan proposed by Mr Persily and approved by the TAC or
c) Issue an RFP to perform work proposed by the TAC (proposal based on work performed by Mr Persily in Phase I

Mr Persily then started his discussion. A handout was given out (attached) that summarized the work done to date. Specifically, the handout summarized:

- The literature review process
- Outline of literature review
- Outstanding Issues and New Information
- Technical Analysis Plan
- Project Status
- Initial thoughts on follow-up phases

Throughout Mr Persily's discussion the TAC commented/gave guidance on various aspects of work done to date and on Mr Persily's initial thoughts on a technical

analysis plan/study proposal. Some of the comments by TAC members included:

- It appears that Mr Persily is ahead of schedule, work to date appears of good quality

- The number of scenarios that could actually be tested or modeled via computer are potentially very large, thus work should center around "catastrophic" type failures in the home such as a cracked heat exchanger in a furnace, automobile in an attached garage etc.

- Any computer model developed/used in subsequent phases of the project need to correlate closely with actual experimental test house results.

- Should not concentrate as much on learning the exact source strength of CO emissions from various sources. If CO dynamics due to 1 source strength/location are known then these findings can probably be applied to other source strengths at that same location

- Death and injury statistics could be looked as a means to identify combustion sources to use in any experiments or modeling

- Any "final product" needs to include CO concentration data verses time at various locations in a home.

- Mr Persily stated that CO dynamics in multifamily dwellings have not been looked at and expressed interest, at least on a limited basis for doing so. A majority of TAC members stated that multifamily dwellings should not be a part of any modeling/testing and that this was outside the scope of the project.

Minutes:

Minutes of this meeting to be provided by the NFPA Research Foundation to all TAC members at a later date.

attachments (1)

National Carbon Monoxide Research Project Literature Review and Technical Analysis Plan

Andrew Persily
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, Maryland

National Fire Protection Research Foundation
Technical Advisory Committee Meeting
Quincy, Massachusetts
12 June 1996

OUTLINE OF PRESENTATION

Literature Review Process

Outline of Literature Review

Outstanding Issues and New Information

Technical Analysis Plan

Project Status

Initial Thoughts on Follow-Up Phases

LITERATURE REVIEW PROCESS

Objective: To learn what is known, and what is not known, about the distribution of CO in family living units in relation to the installation of CO detectors

Sources

TAC members

Personal contacts

AIRBASE (Air Infiltration and Ventilation Centre)

Indoor Air and ASHRAE IAQ Proceedings

Issues

Measurements of residential CO concentrations

Residential CO sources

Air movement and contaminant distribution in family living units

Mixing within and between rooms

Ventilation rates in residential buildings

Tracer gas techniques for measuring airflows

Airflow and contaminant transport models

PERSONAL CONTACTS

Terry Brennan: Camroden Associates

David Grimsrud: University of Minnesota

Tom Phillips: California Air Resources Board

Wayne Ott: Stanford University

Rob deKieffer: SunPower

Linda Sheldon: Research Triangle Institute

A.L. Wilson: Integrated Environmental Services

Joe Rizutto: NYSERDA

Neil Leslie, Ted Williams, Irv Billick, Library: GRI

Greg Traynor: Lawrence Berkeley Laboratory

Matt Wilbur: MiniGasCo

Niren Nagda: Energen Consulting

John Kesselring: EPRI

Roger Hedrick: GARD Analytics

Tom Greiner: Iowa State University Extension

Brad Turk: Mountain West Technical Associates

Mike Koontz: GEOMET Technologies

David Ross: British Research Establishment

John Girman, Lance Wallace: US EPA

OUTLINE OF LITERATURE REVIEW

Introduction

CO Concentrations in Residential Buildings

- **CO Exposure Studies and Residential CO Measurements**
- **CO Levels in Residential IAQ Surveys**
- **Multipoint CO Measurements**
- **Factors Affecting CO Levels in Residential Buildings**

Sources

- **Unvented Combustion Appliances**
- **Vented Combustion Appliances**
- **Other Indoor Sources**
- **Ambient Air**

Multifamily Buildings

- **Airflow Measurements**
- **Airflow Modeling**

Mixing

- **Intra-Room**
- **Inter-Room**

Surveys of Residential Ventilation Rates and House Sizes

Tracer Gas Techniques for Measuring Airflow Rates in Buildings

- **Tracer Gas Techniques for Measuring Interzone Airflow Rates**
- **Tracer Gas Measurements of Interzone Airflow Rates**

Modeling

- **CFD Models**
- **Single-zone Modeling and Application**
- **Multizone Airflow and Contaminant Dispersal Models**

Summary

Technical Analysis Plan

References

LITERATURE REVIEW: PRELIMINARY FINDINGS

CO Concentrations in Residential Buildings

Generally low: 5 ppm or less
Usually higher in source room; differences not always large
Some indication of factors affecting interzone differences: forced-air fans, door position

Residential CO Sources

Measured emission rates from combustion appliances
Some sources not well characterized: spillage, garages

Mixing

Some studies of within room mixing: buoyancy and fans
Within-floor mixing better than between-floor

Residential Ventilation Rates

Regional databases: CA and Pacific NW
Nonrandom national databases
DOE database on residential building characteristics

Available Models

CFD for individual rooms
Multizone airflow and pollutant transport models

Tracer Gas Measurement Techniques

Interzone airflow rates

OUTSTANDING ISSUES AND NEW INFORMATION

Remaining references

AIVC annotated bibliography on garage ventilation

GRI Spillage studies

Proposed ASTM detector standard

Presentation on project at annual NFPA meeting

BRE study of CO detector location

Literature review (complete): detector standards, limited measurements and CFD model capabilities

Experimental work (starting soon, to be completed this fall): CO generator to simulate boiler spillage in test room; CFD modeling to validate tests

Further experimental work: Whole-house tests

TECHNICAL ANALYSIS PLAN

Objectives

Assess information from literature review

Identify and analyze issues related to CO dispersion in family living units

Determine which issues have been covered already and which merit additional study

Analysis Plan

Scenario: building, configuration of that building, CO source, occupant activities, outdoor conditions

Steps in Analysis Plan

Identify building and source factors

Determine available information on factors

Identify critical CO scenarios

Identify information needed to study critical scenarios

Develop study plan to obtain needed information on factors and to study critical scenarios

PROJECT STATUS

TAC meeting to discuss draft literature review and technical analysis plan: 6/12/96

Draft report on technical analysis and study plan: 8/2/96

TAC meeting to discuss draft report: 8/15/96

Final report to NFPRF: 9/26/96

INITIAL THOUGHTS ON FOLLOW-UP PHASES

Phase II

CFD modeling of CO dispersion from buoyant sources in a single room (NIST funded)

Experimental determination of CO generation from appliance spillage in single-room test house; validation of CFD modeling

Experimental determination of CO transport from attached garages to living space

Multizone transport modeling of preliminary cases: key sources, attached garages, multifamily buildings

Phase III

Additional CFD modeling (NIST funded)

Multizone transport modeling of critical scenarios

Experimental determination of CO transport in research houses; validation of multizone modeling